



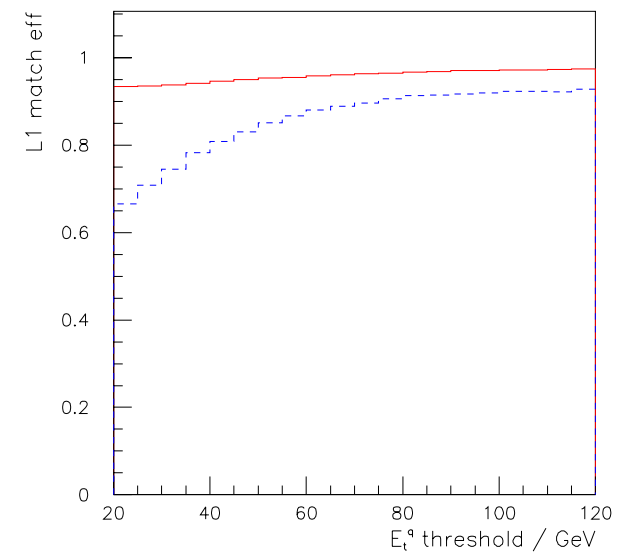
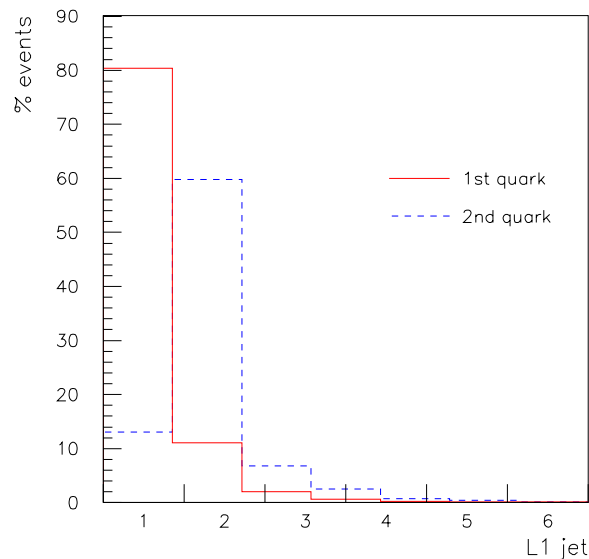
L1 Tag Jet Triggers

- How well can we trigger on tag jets from Weak Boson Fusion at Level-1?
- Intention was for invisible Higgs but can probably be used for leptonic decays as well
- Following results are only possible in a 'best jets' scenario...
- Apply loose cuts on tag quarks (q_{tag}) :
 - 2 tag quarks, $E_t > 20 \text{ GeV}$, $|\eta| < 5.0$
- Some analyses use harder cut, but trying to be as general as possible



Tag Jet ID

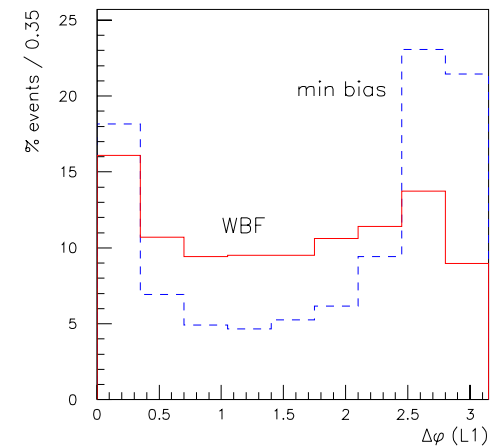
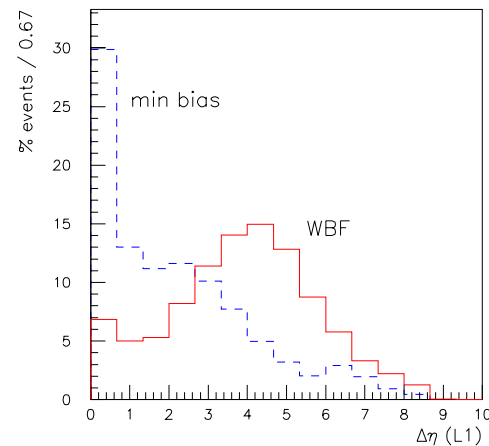
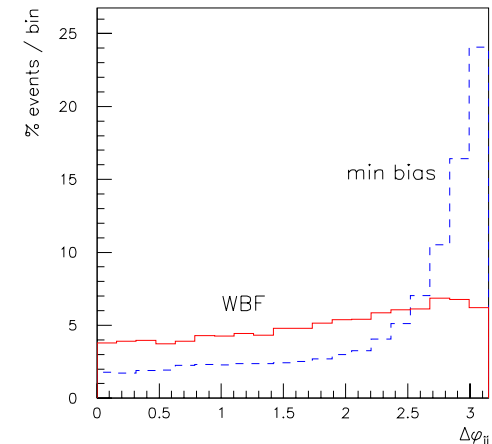
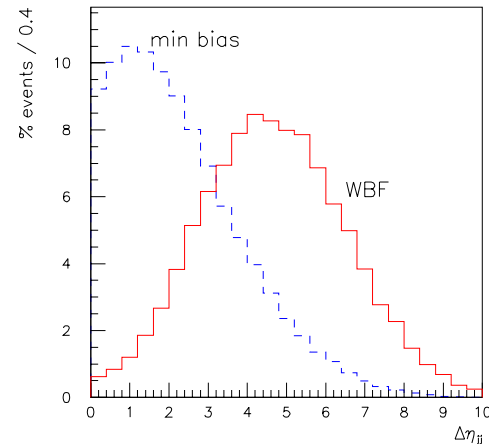
- L1 jets (J_i) matched to tag quarks using $dR < 1.0$
- Similar results using looser dR cut
- Efficiency for L1 selecting a tag quark (wrt q_{tag} cuts) at 2×10^{33} lumi :
 - J_1 : 93%
 - $J_1 \& J_2$: 67%
 - $J_1 \& J_3$: 7%
 - $J_1 \& J_4$: 2%
 - $J_2 \& J_3$: 1%
- Hadrons in Higgs final state will spoil efficiency
- Situation will worsen at 10^{34}





Tag jet topology

- $\Delta\eta$, $\Delta\phi$ for
 - WBF quarks
 - QCD dijets
- Generator level
- Level-1
- Try following cuts :
 - $\Delta\eta > 3.5$
 - $\Delta\phi < 2.5$





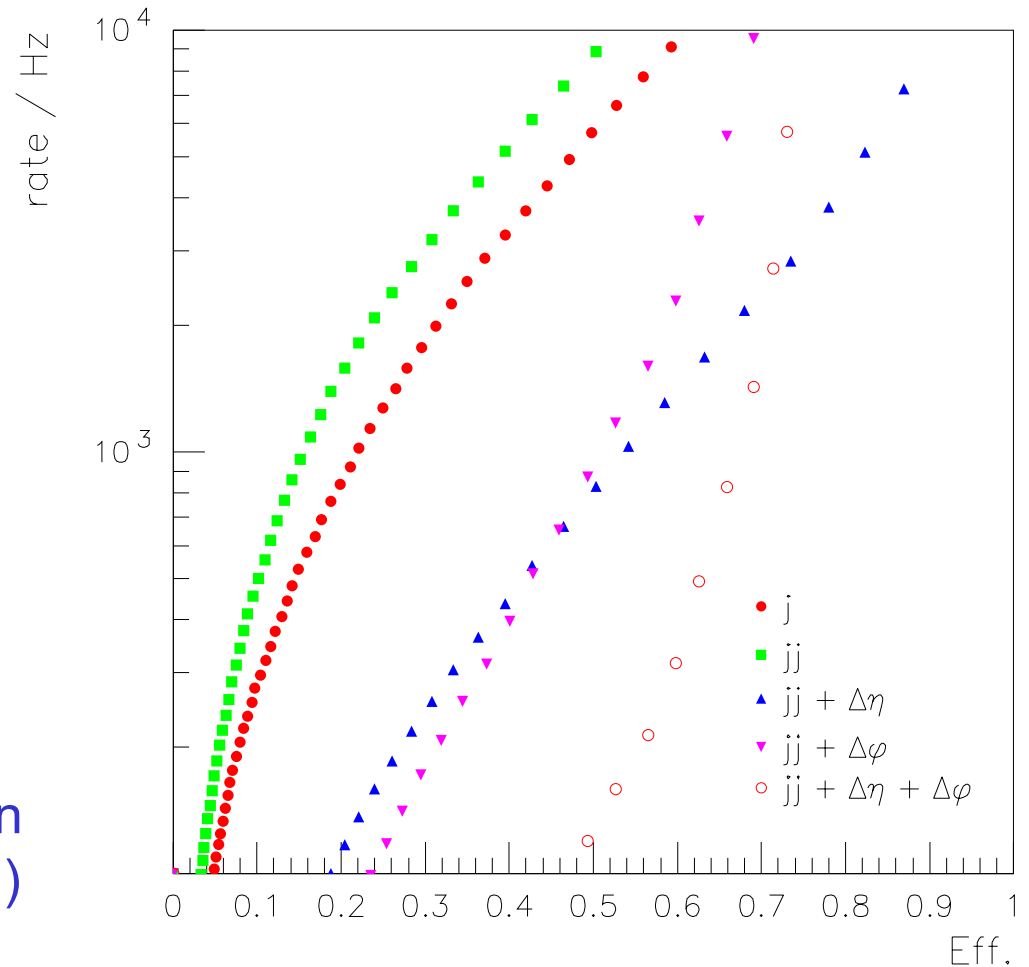
Generator Level 'Trigger'

- Generator level cuts here are :

- $q_{\text{tag}} + \Delta\eta_{\text{qq}} > 3.5$

- 'Dijet + ΔX ' triggers show good improvement over single jet trigger

(Rate may be overestimated on this plot. Under investigation...)





L1 Rate

- Level-1 rates for

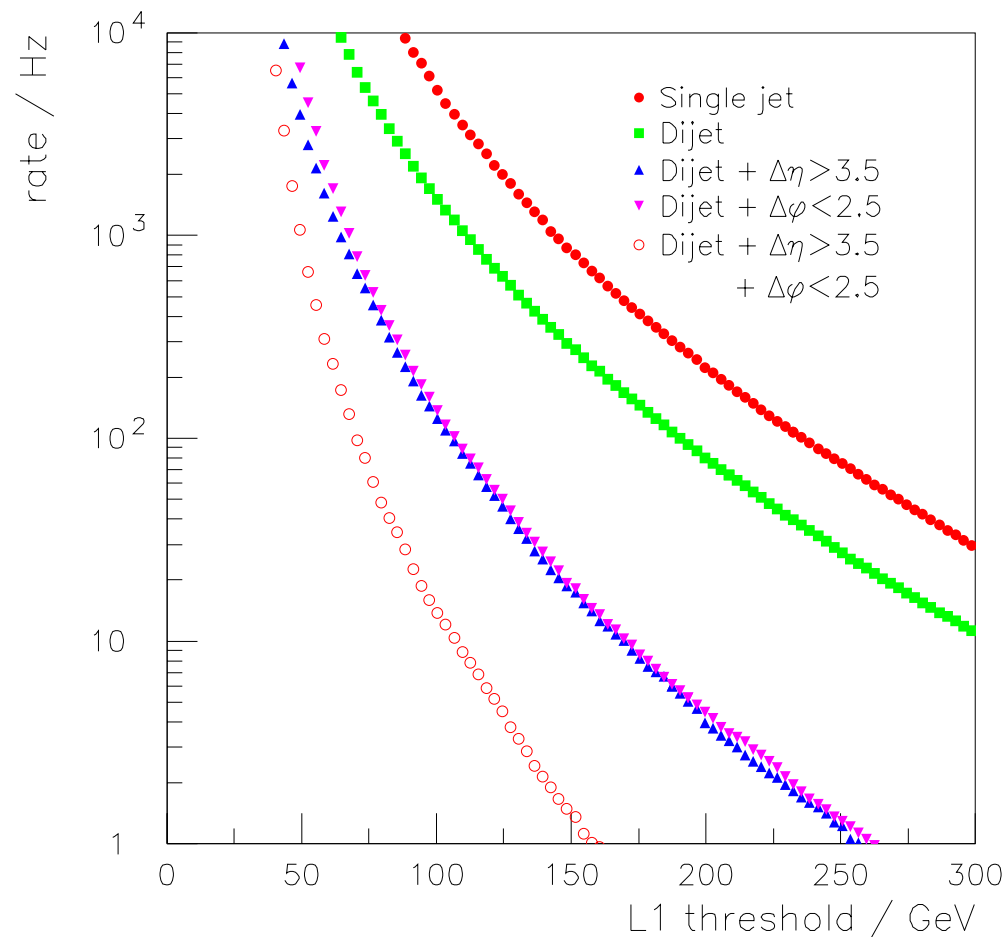
- Single jet
- Dijet
- Dijet + $\Delta\eta$
- Dijet + $\Delta\phi$
- Dijet + $\Delta\eta$ + $\Delta\phi$

- Global Trigger code looks like :

$$E_t(j_2) > X \ \&\& \ \Delta\eta(j_{1,2}) > 3.5$$

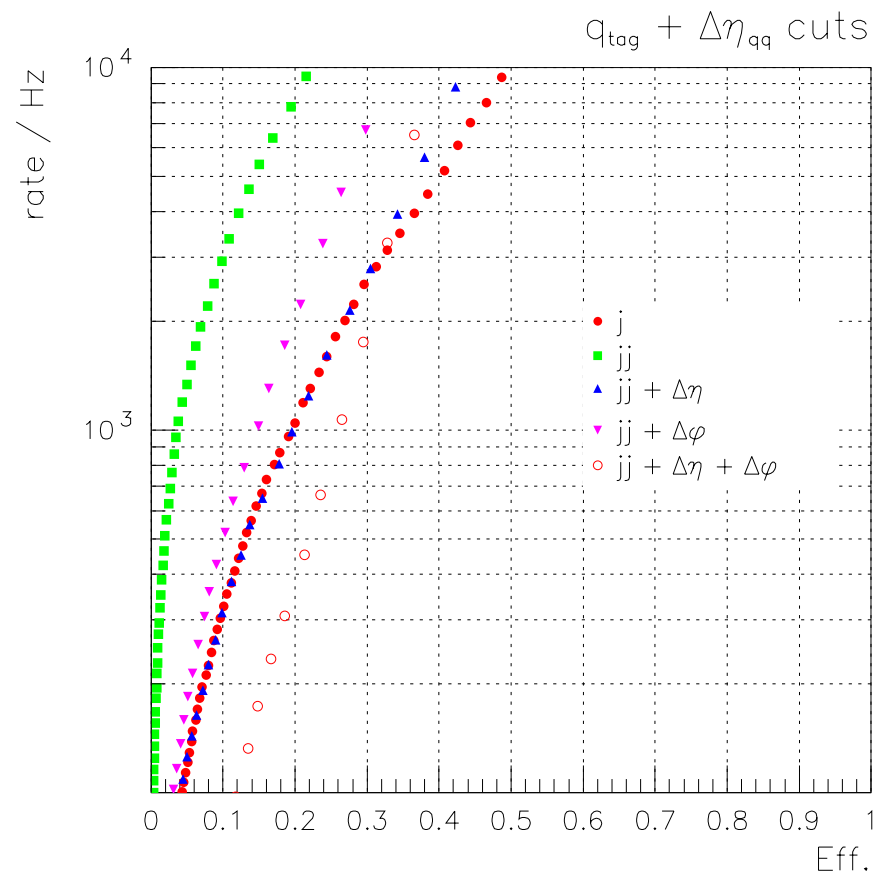
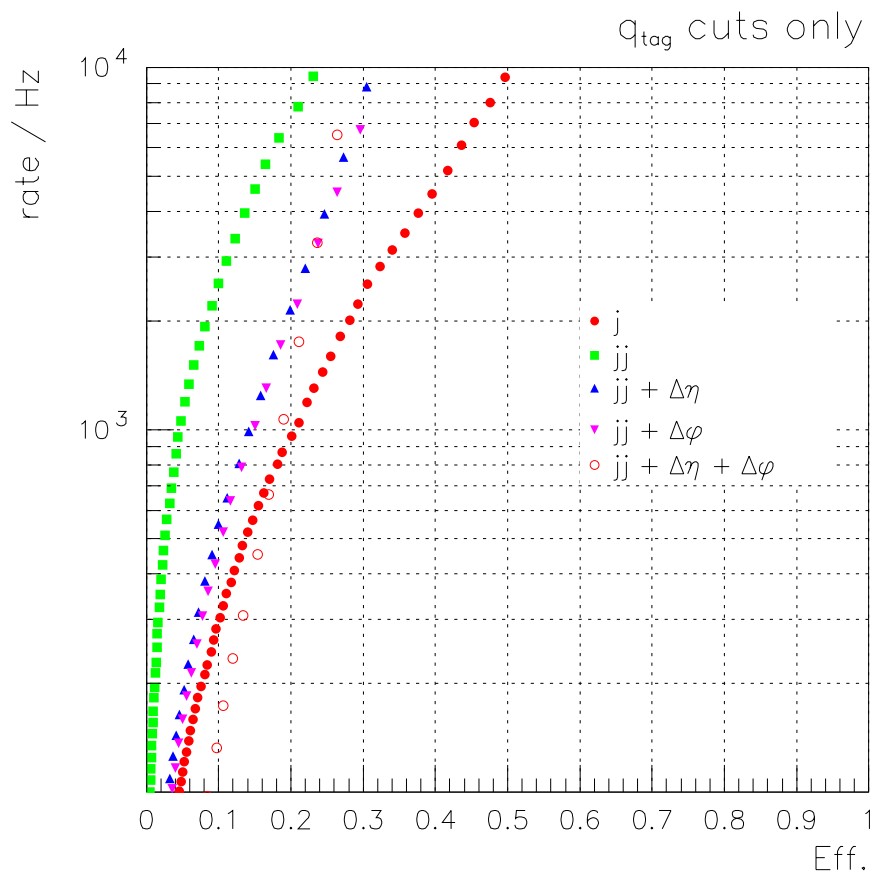
$$E_t(j_2) > X \ \&\& \ \Delta\phi(j_{1,2}) < 2.5$$

$$E_t(j_2) > X \ \&\& \ \Delta\eta(j_{1,2}) > 3.5 \ \&\& \ \Delta\phi(j_{1,2}) < 2.5$$





Rate vs Efficiency I

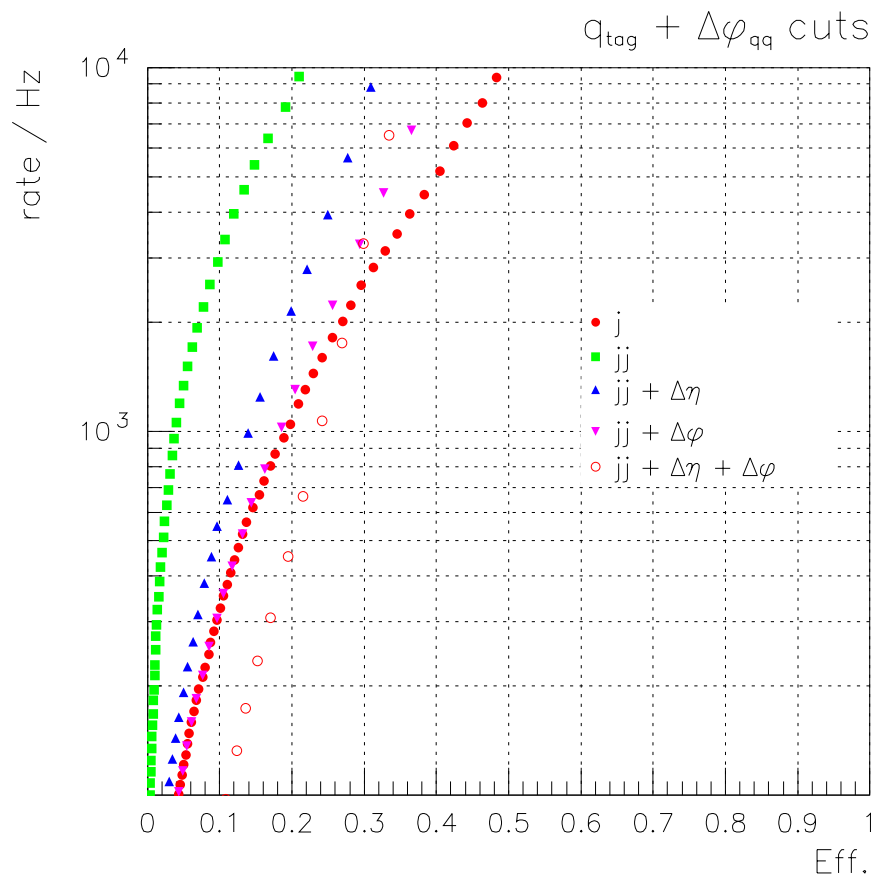


Gen level cuts \longrightarrow q_{tag}

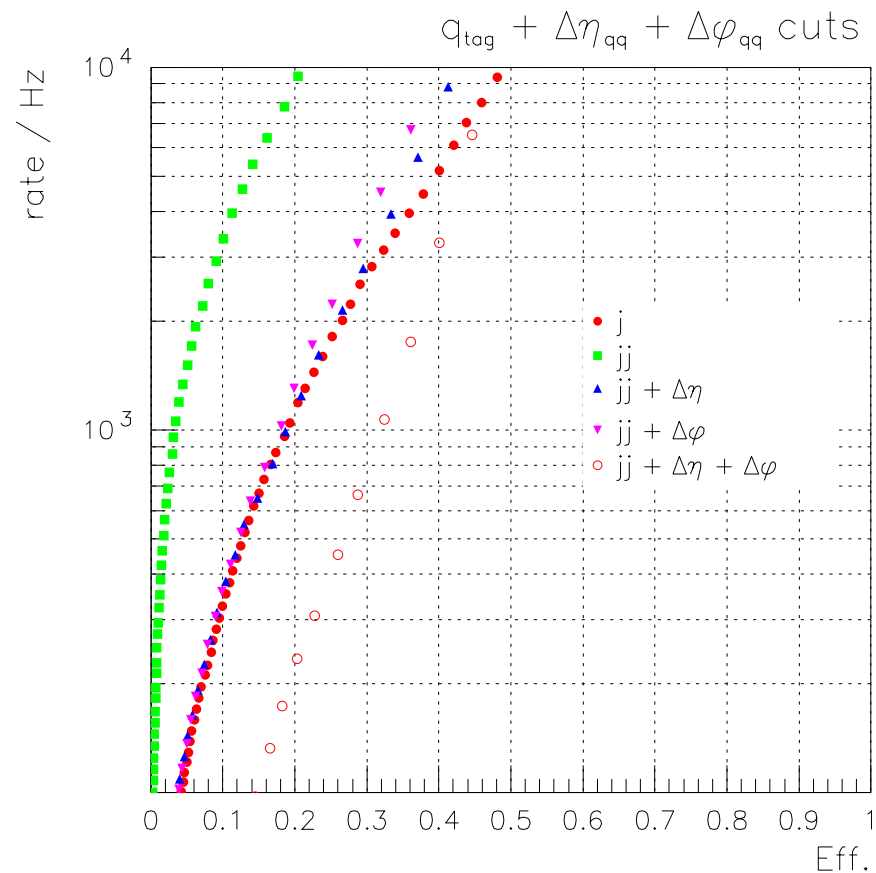
$q_{\text{tag}} + \Delta\eta > 3.5$



Rate vs Efficiency II



$$q_{\text{tag}} + \Delta\phi < 2.5$$



$$q_{\text{tag}} + \Delta\eta > 3.5 + \Delta\phi < 2.5$$



Conclusions

- Efficiency is generally poor....
- 'Dijet + $\Delta\eta$ ' or 'Dijet + $\Delta\phi$ ' triggers at best have efficiency as good as single jet trigger
- 'Dijet + $\Delta\eta$ + $\Delta\phi$ ' most efficient at lower rate for each set of generator level cuts
- Is poor improvement over single jet trigger down to tag jet selection efficiency?



Jets 1 & 3

- Include $\Delta\eta$, $\Delta\phi$ between jets 1 & 3, to boost efficiency...
- GT code now looks like :

$$(E_t(j_2) > X \ \&\& \ \Delta\eta(j_{1,2}) > 3.5) \parallel$$

$$(E_t(j_3) > X \ \&\& \ \Delta\eta(j_{1,3}) > 3.5)$$
- Rate increases slightly, but efficiency only improves for low E_t
- Checking these results now...

